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A new association of relict maquis with *Ptilostemon greuteri* (*Oleo-Ceratonion, Quercetea ilicis*), located in a circumscribed area of north-western Sicily

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Abstract

This paper illustrates the results of a survey aimed at deepening available knowledge on the ecology of *Ptilostemon greuteri* (Asteraceae), a very rare palaeoendemic and relict nano-phanerophyte discovered about 15 years ago on Monte Inici, near Castellammare del Golfo (province of Trapani, north-western Sicily). Two plant communities characterised by *P. greuteri* are described in detail; they occur in the *locus classicus* and in a second, recently discovered stand, which is also very localised and threatened by fire. The field investigations revealed that the sites where the species grows are very similar from the ecological point of view; in fact, both of them are located on the steep slopes of deep gullies, benefitting from constantly cool and shady microclimatic conditions, and allowed to a) better identify the currently preferred habitat (ledges, screes at the base of cliffs), b) analyse from a floristic and phytosociological point of view the maquis communities where *P. greuteri* grows as co-dominant or dominant species, referable to the class *Quercetea ilicis*, c) to identify the syndynamic role that these coenoses play within the series and microgeoseries of local vegetation. As far as syntaxonomy is concerned, the *Malvo olbiae-Ptilostemonetum greuteri* ass. nova is described, a basiphilous, thermophilous and shade-tolerant maquis framed in the *Oleo-Ceratonion* alliance. Moreover, two subassociations are described: 1) *typicum* subass. nova, corresponding to a pioneer maquis community prevailing on the coarse, loose and mobile debris located along the slopes at the base of rock cliffs, where *P. greuteri* is clearly dominant and shows a nano-phanerophytic habitus, and 2) *euphorbietosum bivonae* subass. nova, a primary aspect found of the ledges of carbonate cliffs, where the species can play either a dominant or co-dominant role with other elements of the maquis (*Euphorbia bivonae*, *Chamaerops humilis*, etc.), sometimes showing a slightly smaller size.

Keywords

evergreen Mediterranean maquis, phytosociology, *Pistacio lentisci-Rhamnetalia alaterni*, relict vegetation, syntaxonomy

Introduction

Ptilostemon greuteri is a very rare woody species belonging to the Asteraceae family, described by Raimondo & Domina (2006) for a single locality in north-western Sicily (Mount Inici, municipality of Castellammare del Golfo, Trapani province) just some 15 years ago. This sympodial nanophanerophyte can exceed a height of 3 m and is crown bears 8-10 branches, white-tomentose at the apex, branch off from its striated monocauline stems, forming a dense, globular crown. In contrast to the Mediterranean woody sclerophylls, characterised by small, leathery and strongly cutinous leaves, *P. greuteri* has persistent, soft, long lanceolate, lauriphyllic leaves. Numerous and densely imbricated, these leaves are pinnate, lanceolate and subsessile, flat or slightly convex upwards, their apex obtuse to acute; they grow on the mid-terminal portion of the branches - where they persist for a long time even after drying - and give the plant a very distinctive habitus (Fig. 1). The upper side of the leaves is shiny green, while the lower side is covered with a dense, fluffy-white tomentum. The lower leaves measure 25-35 ×1.3-4

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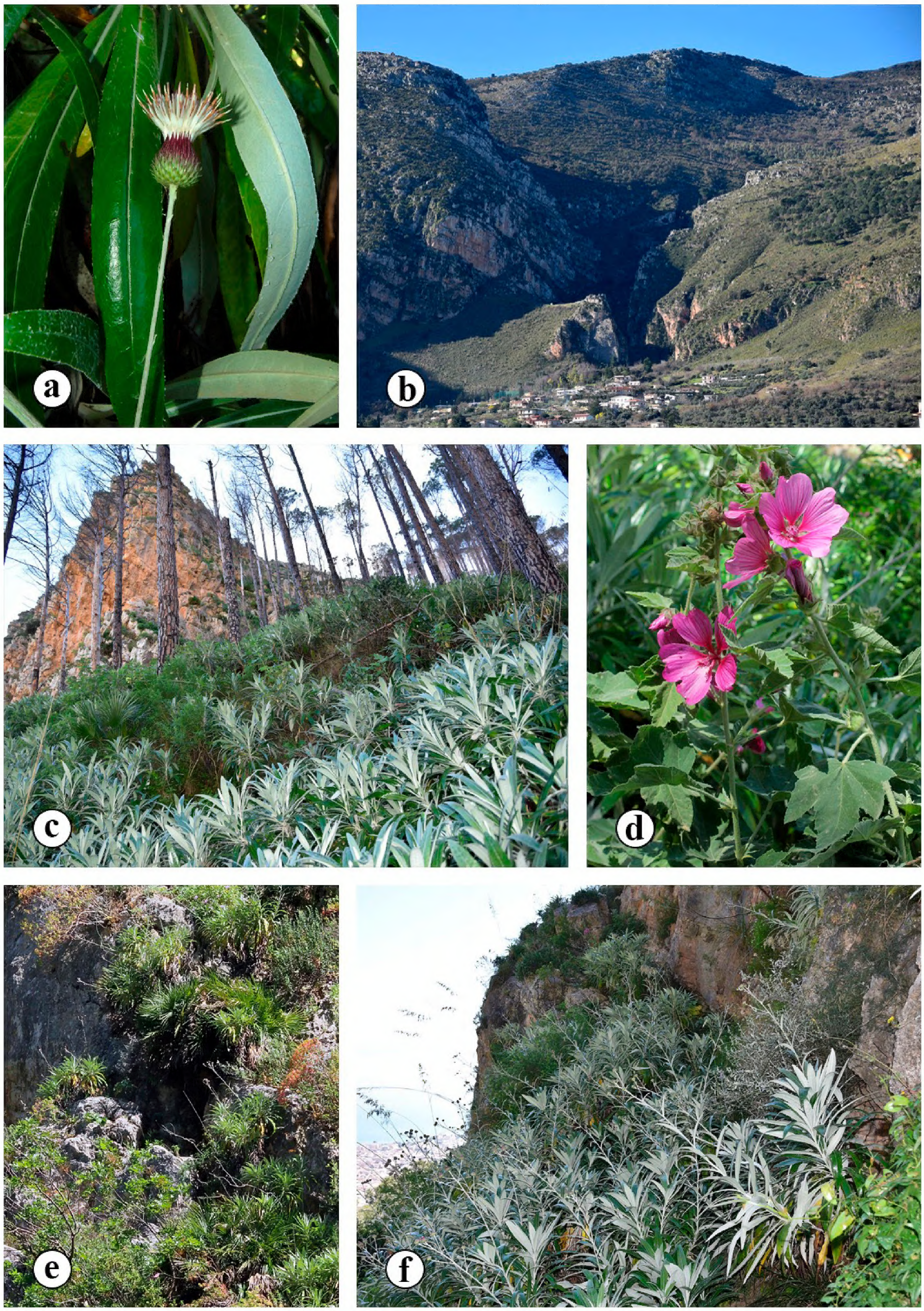

Figure 1. a) *Ptilostemon greuteri*; b) view of the deep gully beneath Cozzo Monaco, on the N-facing slopes of Mount Inici; c) pioneer maquis referred to *Malvo olbiae-Ptilostemonetum greuteri* subass. *typicum*, on the scree of locality Pedrazzi; d) *Malva olbia*, differential species of the coenosis; e-f) subass. *euphorbietosum bivonae*, linked to the rocky ledges in locality Il Finestrone (e) and in locality Pedrazzi (f).

cm, and their size gradually decreases towards the top of the branches, which host lax corymbs bearing 2-8 ovoid flower heads.

The size of the leaves of *P. greuteri* represents a remarkable anomaly in the framework of native woody species from Sicily and the Mediterranean in general: in fact, their large surface area appears a trait that does not fit in well with the long-lasting summer thermo-hydric stress typical of the climatic conditions of the entire basin. In view of its morpho-anatomical peculiarities, *P. greuteri* is considered a palaeoendemic (Brullo & Brullo 2021) whose extreme rarity is presumably a consequence of the glacial and post-glacial climatic changes occurred during the Quaternary. At present, the species grows wild only in two sites (Pasta et al. *submitted*), both of which are of high environmental and conservation value. The phylogenetic position of *P. greuteri* within the genus is still debated; the species was in fact referred to the section *Ptilostemon* by Raimondo & Domina (2006), while subsequent molecular investigations (Vilatersana et al. 2010) suggest it should better be included in the section Pterocaulos.

The survival of this species is threatened by the frequent recurrence of summer fires, the last of which occurred on 2 July 2017 and affected a vast area of Mt. Inici, completely wiping out the adult population of the *locus classicus* (Raimondo et al. 2021; Pasta et al. *submitted*). At the same time, however, the fire caused the partial destruction of the conifer reforestation, eventually favouring the dynamism of the local vegetation where *P. greuteri* occurs, giving rise to a community that is extremely peculiar from a physiognomic point of view in the phytocoenotic panorama of Sicily and probably of the entire Mediterranean Basin.

Drawing on the above observations and considerations, the present work aims at improving the available knowledge on the synecology of the species and its syndynamic role in the plant communities of the area where it grows. Indeed, *P. greuteri* had hitherto been considered a species linked to the local thermophilic chasmophytic communities (Raimondo & Domina 2006; Raimondo et al. 2021), referred to the association *Scabioso creticae-Centauretum ucriae* Brullo & Marcenò 1979 and included in the class *Asplenietea trichomanis* (Br.-Bl. in Meier & Br.-Bl. 1934) Oberdorfer 1977 (Brullo & Brullo 2021). However, the habit of this woody species suggests ascribing the assemblages where this species occurs to the maquis communities belonging to the class *Quercetea ilicis* Br.-Bl. in Br.-Bl., Roussine & Nègre 1952. The surveys carried out made it possible to identify and distinguish from both a floristic and phytocoenotic point of view, two different plant communities in the habitats colonised by *P. greuteri*, i. e. the ledges and fractures on vertical cliffs, and the screes made of unstable and incoherent clastic detritus at the base of the carbonatic relief.

Material and Methods

For the geolithological and geomorphological characteristics of the two locations of *P. greuteri*, the work of Catalano et al. (2011) was consulted. As for local climatic patterns, reference was made to the dataset (years 1926-1985) analysed by Duro et al. (1996), focusing on the closest recording points, i. e. the thermometric station of Calatafimi (350 m a.s.l.), located just 10 km east of the study area (Tab. 1), and the rainfall station of Castellammare del Golfo (15 m a.s.l.), located at the foot of Mount Inici (Tab. 2).

The bioclimatic characterisation of the territory according to the indices of Rivas-Martínez (2004), was performed by consulting Drago et al. (2005) and some scientific papers concerning the whole region of Sicily (Bazan et al. 2015; Gianguzzi et al. 2016b) and some neighbouring areas of the province of Trapani (Gianguzzi & La Mantia 2009). Repeated field surveys focused on local plant communities were carried out between 2018 and

Table 1. Monthly and annual averages of maximum and minimum temperatures (in °C), daily ranges, absolute maximum and minimum values recorded at the thermometric station of Calatafimi (Province of Trapani; from Duro et al. 1996).

Calatafimi (350 m a.s.l.)						
Month	**Max**	**Min**	**Med**	**Temp. range**	**Abs. Max.**	**Abs. Min.**
January	11.9	6.0	9.0	5.9	20.0	-1.5
February	12.3	5.8	9.1	6.5	22.4	-0.8
March	15.4	7.2	11.3	8.2	26.5	-0.9
April	19.1	9.3	14.2	9.8	29.1	3.0
May	22.9	11.9	17.4	11.0	38.2	5.6
June	28.6	16.5	22.6	12.1	39.3	5.6
July	32.4	19.2	25.8	13.2	41.0	10.0
August	31.3	19.7	25.5	11.6	41.7	13.4
September	27.0	17.3	22.2	9.7	39.3	11.5
October	22.8	14.1	18.5	8.7	38.4	6.2
November	18.1	10.5	14.3	7.6	27.3	4.0
December	13.7	7.4	10.6	6.3	24.0	-2.0
Year	**21.3**	**12.1**	**16.7**	**9.2**	**41.7**	**-2.0**

Table 2. Monthly and annual average values of rainfall (mm/m²) and number of rainy days recorded at the rainfall station in Castellammare del Golfo (Province of Trapani; from Duro et al. 1996).

CASTELLAMMARE DEL GOLFO (15 m a.s.l.)		
Month	**mm**	**Rainy days**
January	94.2	12
February	84.9	11
March	66.7	9
April	46.5	7
May	22.5	4
June	9.6	2
July	3.9	1
August	11.9	2
September	42.4	4
October	77.9	8
November	87.9	10
December	98.7	12
Year	**647.1**	**82**

2022 and allowed to make several phytosociological relevés, performed following the Zurich-Montpellier School methodology, i.e. adopting the abundance-dominance indices proposed by Braun-Blanquet (1964), updated according to the suggestions by Géhu & Rivas-Martínez (1981) and Biondi (2011). The treatment of the syntaxa mentioned in the text follows the criteria of the International Code of Phytosociological Nomenclature (ICPN: Theurillat et al. 2021).

For the classification of the vascular plants found during field surveys, reference was made to the Pignatti et al. (2017–2019), while the nomenclatural treatment of the vascular plant taxa follows Bartolucci et al. (2018). To produce a synoptic overview of phytosociological data concerning the Sicilian syntaxa framed into the alliance *Oleo-Ceratonion*, reference was made to Brullo et al. (2009) and several recent works, cited in the text.

Study area

Fig. 2 provides an updated distribution map of *P. greuteri*, showing the position of the second subpopulation, recently discovered c. 2.2 Km south of the *locus classicus* (Pasta et al. *submitted*).

The study area concerns the northern slopes of Mt. Inici (1,064 m a.s.l.), which falls within the municipal territory of Castellammare del Golfo (Trapani province), where the two stands of *P. greuteri* are located. Both sites share many ecological patterns (Pasta et al. *submitted*): they are located at intermediate altitudes between Cozzo Monaco (771 m a.s.l.), Pizzo Brando (635 m a.s.l.), Pizzo Stagnone (783 m a.s.l.) and Pizzo del Dottore (620 m a.s.l.); morevoer, they both fall within two Natura 2000 sites, the Special Protection Areas ITA010029 "Monte Cofano, Capo San Vito e Monte Sparagio" and ITA010015 "Complesso dei Monti di Castellammare del Golfo". From a geolithological point of view, both sites are characterised by Trias-Lias carbonate platform deposits, ascribed to the Trapanese Domain and mainly referred to the "Monte Bonifato-Calatubo" Unit, which is covered by sediments belonging to the "Monte Inici" Unit. The substrates are made of dolomitic limestones with megalodonts, stromatolitic and lopheritic dolomites, calcilutites rich in algae and foraminifera (Catalano et al. 2011). The slopes of Mt. Inici are partially covered with coarse and loose clastic debris resulting from the continuous collapse of rocks from the nearby vertical cliffs. The slopes are rather steep and furrowed by several incisions, where water flows during the most abundant and violent rainfall events, concentrated between autumn and spring. Both subpopulations occur in cool and shady habitats within two of these gullies, characterised by a thick cover of incoherent and unstable debris. While awaiting the interpretation of the meso- and microclimatic data collected at both *P. greuteri* stands (Marcenò et al. *submitted*), local mesoclimatic patterns were inferred from the thermometric data recorded at the Calatafimi station (Tab. 1), while reference was made to the station of Castellammare del Golfo for rainfall values (Tab. 2). More in detail, as far as rainfall is concerned, the annual average value is 642 mm, distributed over a total of 82 days; the mean daily temperatures are around 16.7 °C, with monthly averages ranging from 9 °C (January) to 26.7 °C (August) and average annual excursions of 9.2 °C; the absolute maximum and minimum temperatures recorded are 41.7 °C in August and -2.0 °C in December, respectively. The proximity of the sea strongly influences local climate, which is characterised by a particularly mild winter season: in fact, the average maximum temperatures of the coldest months are 11.9 °C in January and 12.3 °C in February.

According to the classification proposed by Rivas-Martínez et al. (2004a), the study area is subject to an oceanic pluviseasonal Mediterranean bioclimate. Based

on the available thermo-pluviometric data, the area falls within the upper thermo-Mediterranean belt with a lower sub-humid ombrotype.

From a biogeographical point of view, the area belongs to the Mediterranean Biogeographical Region, Western Mediterranean Subregion, Italo-Tyrrhenian Province, Sicilian Sector (Rivas-Martínez et al. 2004b), Western Subsector, Drepano-Panormitan District (Brullo et al. 1995).

Results

Description of the stands of *Ptilostemon greuteri*

P. greuteri counts two separate subpopulations whose main physiographic, geolithological, bioclimatic and physiognomic characteristics are described below.

The stand of locality Pedrazzi represents the *locus classicus* of the species (Raimondo & Domina 2006) (Fig. 3). It is located along the eastern slopes of Mt. Inici between 300 and 500 m a.s.l. Here, *P. greuteri* colonises the areas included in the cone of shadow of a rocky outcrop that rises to 523 m a.s.l., just north of Pizzo Stagnone (704 m a.s.l.). The area that hosts this stand is very steep (average slope 30-40°) and is characterised by the widespread presence of coarse detrital materials that have fallen from the rocky cliffs above. This stand hosts a dense vegetation, here and there even luxuriant and continuous, mostly settled in the undergrowth of a sparse *Pinus pinea* reforestation, with some fragments also localized on the rocky ledges (Tab. 3, rel. 9; Fig. 1c-1f.). Many of these stone pines are dying and bear blackened trunks, testifying the high frequency of local fires, that have severely reduced the cover of the artificial forest over the last few decades. In the lower part of this stand, the distribution of *P. greuteri* appears to be delimited by a forest road climbing up to Mt. Inici, while towards the north the species does not go beyond the torrential incision, being completely absent on the opposite slope, facing E-SE, characterised by a reduced presence of debris, a more marked xericity and subject to a clearly more intense and prolonged solar radiation. Upwards, the species spreads up to about 500 m a.s.l., where, however, its presence appears increasingly sporadic, its cover much more discontinuous and the species plays a minor role, gradually replaced by grasslands with *Ampelodesmos mauritanicus*, garrigues with *Cistus creticus* subsp. *eriocephalus* or shrublands with *Spartium junceum*. The prevailing exposition of the locus classicus stand is N-NW; it counts at least 5000 reproductive individuals, distributed over an area of about 6.1 hectares (Pasta et al. *submitted*).

The second stand of *P. greuteri* of Locality Il Finestrone, was found at intermediate altitudes on the eastern slope of Mt. Inici, on the right side of a deep gully, between the carbonate outcrops of Pizzo Brando (546 m a.s.l.) and Cozzo Monaco (774 m a.s.l.). This subpopulation is located at altitudes between 320 and 420 m a.s.l., with prevalent

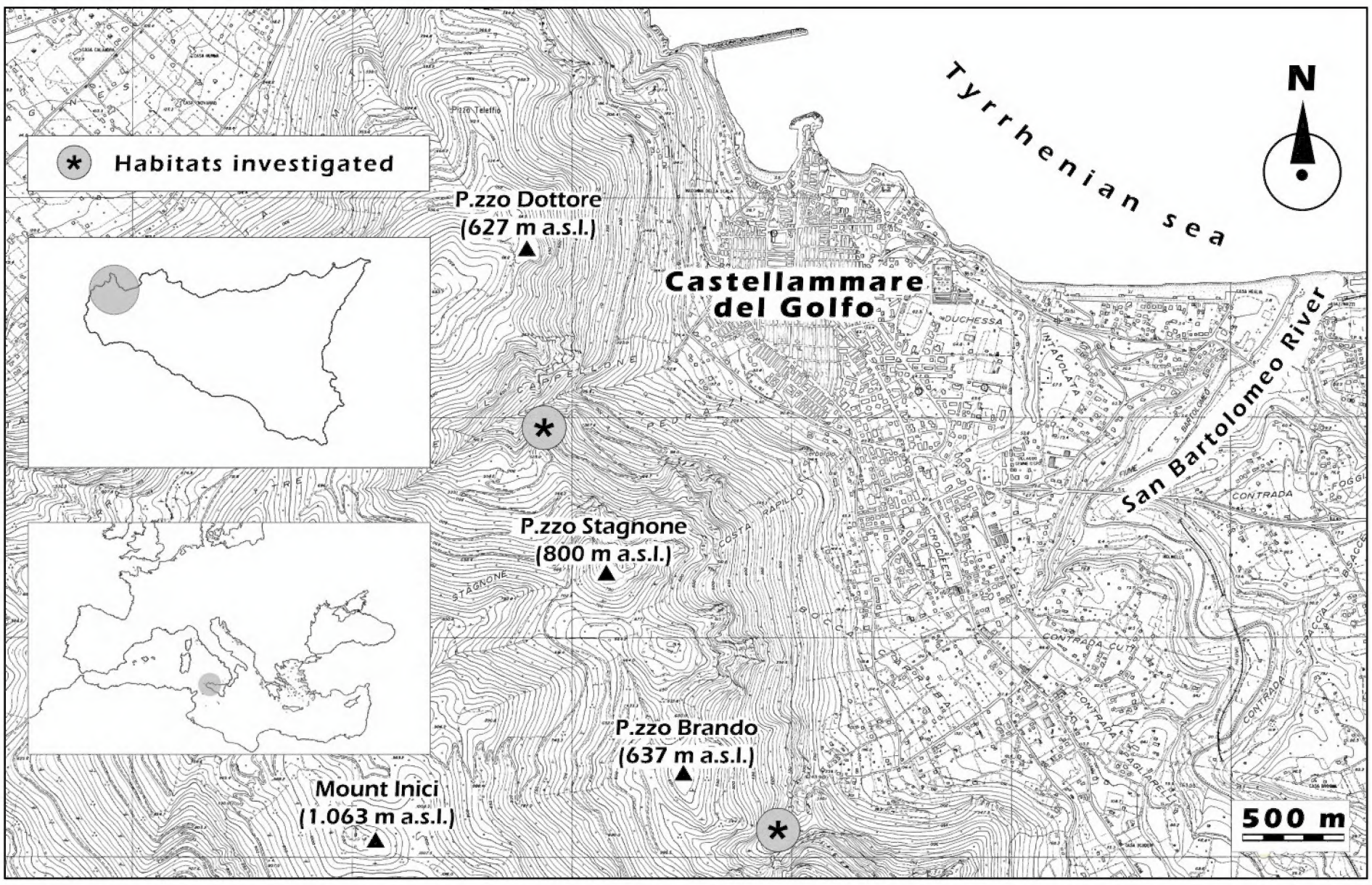

Figure 2. Study area.

N-NW exposure. Part of local subpopulation is distributed on the ledges unevenly dispersed over the sub-vertical rock cliffs of Pizzo Monaco. Notwithstanding their small surface, being exposed to moist sea breeze, almost inaccessible to grazing herbivores and sheltered from frequent fires, these ledges play a key role as refuge areas for *P. greuteri*, and probably favoured its survival until present day. In this context, the species grows together with numerous elements of the thermoxerophilous Mediterranean scrub, building a pioneer scrub coenosis.

Larger and taller individuals of *P. greuteri* grow scattered on the moving scree that covers the bottom of the gully below the cliffs, dominated by a very dense scrub community.

This second subpopulation of *P. greuteri* extends over about 1.9 hectares and is estimated to contain around 200-300 mature individuals (Pasta et al. *submitted*).

Phytosociological and synecological analysis

Tab. 3 includes 12 surveys carried out in both stands within the plant communities dominated or co-dominated by *P. greuteri*. These surveys led to identify a new maquis association referred to the class *Quercetea ilicis*, described in the following text; furthermore, two different variants have been recognized and described as two distinct subassociations.

MALVO OLBIAE-PTILOSTEMONETUM GREUTERI ass. nova (Tab. 3, rels 1–8; *holotypus*: rel. 5)
- *TYPICUM* subass. nova

Diagnostic species of the association and of subass. typicum: *Ptilostemon greuteri* (dominant), *Malva olbia*, *Centranthus ruber*, *Teucrium flavum*, *Acanthus mollis*, *Dryopteris pallida* subsp. *pallida*, *Clematis cirrhosa*, *Helminthotheca aculeata*, *Smyrnium olusatrum*.

Short description: rather dense and in places luxuriant secondary scrub, 2 to 3 m high, bound to detrital-clastic slopes [Fig. 2 (c and d)]. In this community *P. greuteri* plays a clearly dominant physiognomic role, and is associated with several elements of the *Oleo-Ceratonion siliquae* alliance and the order *Pistacio-Rhamnetalia alaterni* (*Pistacia terebinthus*, *Chamaerops humilis*, *Teucrium flavum*, *T. fruticans*, *Stachys major*, *Clematis cirrhosa*, *Rhamnus alaternus* and *Pistacia lentiscus*) and of the class *Quercetea ilicis* (*Ampelodesmos mauritanicus*, *Smilax aspera*, *Rubia peregrina*, *Melica minuta* subsp. *latifolia*, *Asparagus acutifolius*, *Arisarum vulgare*, *Fraxinus ornus*, *Emerus major* subsp. *emeroides*, *Quercus ilex*, *Dioscorea communis*, *Cyclamen hederifolium*, *Ruscus aculeatus*, *Lonicera implexa*, *Allium subhirsutum*, *Rosa sempervirens*, *Asplenium onopteris*, etc.). The coenosis is proposed as a new association (*Malvo olbiae-Ptilostemonetum greuteri*), whose characteristic specific combination also includes the following species: *Malva olbia*, *Centranthus ruber* and *Teucrium flavum*. This community shows a rather high species-richness and is particularly rich in shade-tolerant and nitrophilous species like *Acanthus mollis* and *Smyrnium olusatrum*, and/or other plants linked to incoherent substrates, such as *Dryopteris pallida* subsp. *pallida*. These three species are indicated in the characteristic combination together with two others frequently occurring species, i.e. *Clematis cirrhosa* and *Helminthotheca aculeata*. *Brachypodium retusum* is rather common, too.

Substratum: loose and coarse calcareous debris and boulders located at the base of N-NW-facing slopes, mostly in the shadow cone of steep rocky cliffs (30-40°).

Bioclimate: oceanic pluviseasonal Mediterranean, upper thermo-Mediterranean thermotype with lower sub-humid ombrotype.

Syndynamism: the presence and distribution of this community is linked to the frequent rock collapses from the adjacent cliffs. In fact, *P. greuteri* colonises the shaded microhabitats of torrential incisions, and takes part to a community that tends towards the climatophilous holm oak forest ascribed to the *Rhamno alaterni-Quercetum ilicis* (Brullo & Marcenò 1985; Brullo et al. 2009; Gianguzzi et al. 1996, 2016a), through an intermediate dynamic step represented by a thicket with *Fraxinus ornus, Pistacia terebinthus, Emerus major* subp. *emeroides* [Fig. 3 (3)] and occasionally *Rhus coriaria*. The holm oak series (*Rhamno alaterni-Querco ilicis sigmetum*) plays an edapho-climacic role on the coastal slopes of north-western Sicily, being in contact with the chasmophilous communities typical of the calcareous rock cliffs referred to the alliance *Dianthion rupicolae*. The degradation of local forest communities gives rise to tussock-dominated grasslands of the association *Helictotricho convoluti-Ampelodesmetum mauritanici* (Brullo et al. 2009).

Distribution: this coenosis was detected in Locality Pedrazzi, along the gulley called Vaddunicchio, i. e. the locus classicus of *P. greuteri*. Repeated observations over the last few years show that this scrub community is fastly spreading, probably benefiting from the drastic thinning of the artificial forest cover (*Pinus pinea*), caused by the extensive fire that broke out on 2 July 2017. In fact, recent repeated fire events probably provided a new opportunity to local plant communities, triggering a dynamic process towards the recovery of the local series-head represented by the holm oak forest (*Rhamno alaterni-Quercetum ilicis*).

On the one hand, the development of pine canopy following the reforestation carried out around the 1950s-60s on the slope has probably compromised local subpopulation of *P. greuteri*, reduced to small nuclei relegated on the nearby ledges and rock cliffs. On the other hand, after last fire, *P. greuteri* was able to exploit the new clearings created by the collapse of dead pines, finding favourable growth conditions, and participating the fast and still ongoing dynamic process of local native vegetation, apparently pointing towards the recovery of holm oak forest.

- *EUPHORBIETOSUM BIVONAE* subass. nova (Tab. 3, rels 9–12, *holotypus*: rel. 10).

Diagnostic species: *Ptilostemon greuteri* (dominant or co-dominant), *Euphorbia bivonae, Erica multiflora, Silene fruticosa*.

Short description: lithophilous, shade-tolerant and thermophilous maquis, 1 to 2 m high, linked to rocky ledges located on calcareous cliffs within the coolest and shadiest sector of deep gullies. *P. greuteri* can thrive under these suboptimal but undisturbed conditions, showing a smaller size (average height 0.8-1.2 m) and only rarely playing a dominant role (Rel. 9: Locality Pedrazzi), more frequently behaving as co-dominant (Rels 10–12: below Pizzo Monaco) together with *Euphorbia bivonae*, a summer-deciduous woody spurge with a southern-Mediterranean distribution, only occurring on the calcareous cliffs along the coast between Palermo and Trapani, and in some steep S-facing slopes of the Sicani Mountains (Giardina et al. 2007); this variant is also associated with Erica multiflora and other chasmophytes typical to local cliffs and ledges such as *Silene fruticosa*, included among the specific combination characteristics of this lithophilous coenosis. In this community are also frequent *Chamaerops humilis* and many more species characteristic of the alliance *Oleo-Ceratonion siliquae* and the class *Quercetea ilicis*.

Substratum: N-NW-facing small ledges (average slope of 30-40°), located in cool and shady stations, on limestone-dolomitic cliffs present on the northern slopes of M. Inici, unreachable by herbivores and sheltered from fire.

Bioclimate: pluviseasonal-oceanic Mediterranean, in the upper thermo-Mediterranean belt with a lower sub-humid ombrotype.

Syndynamism: this low-growing edapho-climacic and pioneer maquis occurs on unspoiled primary habitats of extremely high conservation interest, being poorly accessible to herbivores and protected from fire damages [Fig. 3 (2)]. These topographical contexts are of high conservation interest, as they probably represent the last refuge site where *P. greuteri* could have escaped te extinction that presumably occurred elsewhere during the coldest phases of the last glacial cycles. Here *P. greuteri* takes part to a plant community which is in catenal contact with the chasmophilous association *Anthemido cupanianae-Centauretum busambarensis* Brullo & Marcenò 1979 subass. *scabiosetosum creticae* (alliance *Dianthion rupicolae*).

Distribution: this coenosis is frequent in locality Il Finestrone and below Pizzo Monaco [Fig. 2 (b and e)], while it is more sporadic in locality Pedrazzi [Fig. 2 (f)].

Syntaxonomic interpretation

Tab. 3 includes 12 phytosociological relevés carried out in both localities Pedrazzi and Il Finestrone, in the territory of Castellammare del Golfo. These relevés provide an outline of the characteristics of the new association described here. *Malvo olbiae-Ptilostemonetum greuteri* is a low and usually dense maquis formation, physiognomically characterised by the striking dominance of *P. greuteri*, a laurophyllic phanerophyte that gives a very peculiar habitus to the whole community, with several cespitose and lianose phanerophytes/nano-phanerophytes co-occurring in the shrub layer, and with an herb-dominated understorey rich in hemicryptophytes and geophytes.

Based on field observations and the semi-quantitative analysis of the survey data, the authors propose to include this community in the class *Quercetea ilicis* (order *Pistacio-Rhamnetalia alaterni*, alliance *Oleo-Ceratonion*). This choice is based on the high number of plants (12-15 taxa per relevé: see Tab. 3, rels 1-8) considered as characteristics of the afore-mentioned syntaxa. These taxa clearly prevail over the species of forest edges and mantle communities ascribed to the class *Crataego-Prunetea* (mostly summer green deciduous phanerophytes) and over the rupicolous species referred to the class *Asplenietea trichomanes* (where the vegetation hosting *P. greuteri* were previously included). In fact, the species characteristic to the latter two classes plays a secondary role from the physiognomic point of view, and they sporadically occur in the relevés just as transgressive species that usually take part to other communities present in the neighbouring areas.

Despite being dominated by an extremely narrow-ranged palaeoendemic plant, the *Malvo olbiae-Ptilostemonetum greuteri* shows a surprising high vitality and ecological plasticity. The primary aspects - referred to the subass. euphorbietosum bivonae - characterise fragments of shade-tolerant and relict low maquis (rels 9–12), located on almost inaccessible rocky ledges and small cracked surfaces on steep carbonatic cliffs. Here, *P. greuteri* and *Euphorbia bivonae*, often co-dominant, are associated with many other phanerophytes, like *Chamaerops humilis*, *Pistacia terebinthus*, *Teucrium flavum*, *Prasium majus*, etc., and with the perennial tussock grass *Ampelodesmos mauritanicus* (common in many primary communities of the class *Quercetea ilicis*; see Gianguzzi et al. 2015, 2016). Other frequently occurring species are proposed among the characteristics of the association, like *Centranthus ruber*, *Malva olbia* - seldom recorded within the *Oleo-Ceratonion* communities and considered by several authors as a characteristic of the *Pruno-Rubion* alliance (class *Crataego-Prunetea*) - and several lianas referred as characteristics of both the class *Crataego-Prunetea* and *Quercetea ilicis*, like *Smilax aspera*, *Rubia peregrina*, and *Lonicera implexa*.

A secondary aspect of the investigated community - referred to subass. typicum – mostly occurs on scree, and is currently spreading, especially in locality Pedrazzi. This plant community plays an important role in local vegetation dynamics, representing the stage that precedes the development of the holm oak woodland of the association *Rhamno alaterni-Quercetum ilicis*. Even if its dynamic role could induce to interpret this community as a mantle assemblage and to frame it into the class *Crataego-Prunetea*, the authors believe that it is more correct to treat it as a secondary scrub formation belonging to *Oleo-Ceratonion*, just like other synecologically similar associations, such as *Rhamno alaterni-Euphorbietum dendroidis*. Indeed, this latter coenosis may be considered a vicariant of the *Malvo olbiae-Ptilostemonetum greuteri* on the screes, steep slopes

Table 3. Phytosociological table of *Malvo olbiae-Ptilostemonetum greuteri* subass. *typicum* (a) and subass. *euphorbietosum bivonae* (b).

		a								b					
	Relevé number	1	2	3	4	5	6	7	8	9	10	11	12		
	Altitude (m a.s.l.)	295	340	340	380	390	400	375	380	360	380	390	390		
	Slope (°)	30	50	35	37	30	35	38	45	35	70	60	60		
	Aspect	N	NE	N	NW	W	W	N	N	W	NW	NW	NW		
Life	Area (m²)	80	100	100	100	100	100	100	80	80	60	60	60		
form	Total cover	100	95	95	95	95	90	95	100	90	95	90	90		
	Shrub cover (%)	95	90	90	95	95	90	90	90	90	90	80	85		
	Herb cover (%)	50	80	65	60	80	80	30	45	40	40	50	40		
	Average vegetation height (m)	1.4	1.4	1.2	1.3	1.2	1.1	2.8	3.3	0.9	0.8	0.8	1.0		
	Nb. of species per relevé	34	41	35	36	40	37	31	33	21	17	18	17	Presence	Frequency
	Char. of association														
NP	*Ptilostemon greuteri* Raimondo & Domina	4	5	4	5	5	4	4	4	4	2	2	2	12	V
P caesp	*Malva olbia* (L.) Alef.	3	1	2	2	2	1	1	+	+	1	1	1	12	V
Ch suffr	*Centranthus ruber* (L.) DC.	1	2	1	.	1	1	2	1	1	1	+	1	11	V
Ch frut	*Teucrium flavum* L.	+	1	.	+	2	1	1	+	1	1	.	+	10	V
	Char. of subassociation *typicum*														
H scap	*Acanthus mollis* L.	2	2	3	2	2	2	+	1	.	.	.	+	9	IV
G rhiz	*Dryopteris pallida* (Bory) Maire & Petitm. subsp. *pallida*	2	+	2	2	1	1	1	1	.	.	.	.	8	IV
P lian	*Clematis cirrhosa* L.	.	+	1	2	1	.	2	1	.	.	.	.	6	III
H scap	*Helminthotheca aculeata* (Vahl) Lack	+	1	1	1	1	+	.	.	.	.	.	.	6	III
H bienn	*Smyrnium olusatrum* L.	+	+	+	.	1	+	.	.	.	.	.	.	5	III
	Char. of subassociation *euphorbietosum bivonae*														
NP	*Euphorbia bivonae* Steud.	.	1	.	1	.	.	.	.	1	3	2	2	6	III
P caesp	*Erica multiflora* L.	.	.	.	.	.	.	.	.	1	1	2	1	4	II
Ch suffr	*Silene fruticosa* L.	.	.	.	.	.	.	.	.	1	1	+	.	3	II
	Char. of all. *Oleo-Ceratonion* and ord. *Pistacio-Rhamnetalia alaterni*														
P caesp	*Pistacia terebinthus* L.	1	1	+	1	2	1	2	1	1	1	.	+	11	V
NP	*Chamaerops humilis* L.	1	1	.	1	1	2	.	.	2	2	1	2	9	IV
Ch frut	*Stachys major* (L.) Bartolucci & Peruzzi	1	2	.	1	.	.	.	1	.	+	1	.	6	III
P caesp	*Rhamnus alaternus* L.	+	.	1	.	.	.	1	1	.	.	.	.	4	II
NP	*Teucrium fruticans* L.	.	.	.	.	+	1	.	.	1	.	1	.	4	II
P caesp	*Pistacia lentiscus* L.	1	.	.	1	.	.	.	.	.	.	.	.	2	I
	Char. of cl. *Quercetea ilicis*														
H caesp	*Ampelodesmos mauritanicus* (Poir.) T. Durand & Schinz	3	1	2	3	1	3	1	1	1	1	1	2	12	V
G rhiz	*Smilax aspera* L.	1	1	+	3	2	3	2	2	1	.	.	1	10	V
P lian	*Rubia peregrina* L.	2	2	1	2	2	2	2	2	1	+	.	.	10	V
H caesp	*Melica minuta* L. subsp. *latifolia* (Coss.) W. Hempel	+	1	1	.	1	+	1	1	1	.	+	.	9	IV
G rhiz	*Asparagus acutifolius* L.	1	1	.	2	+	1	1	1	1	.	+	.	9	IV
G rhiz	*Arisarum vulgare* Targ. Tozz.	1	1	1	2	2	1	.	1	.	.	.	.	7	III
P scap	*Fraxinus ornus* L.	2	1	1	1	.	.	1	1	.	.	1	.	7	III
NP	*Emerus major* Mill. subsp. *emeroides* (Boiss. & Spruner) Soldano & F. Conti	1	1	.	+	.	.	.	.	3	+	1	2	7	III
P scap	*Quercus ilex* L.	.	2	1	1	.	.	1	2	.	1	.	2	7	III
G rad	*Dioscorea communis* (L.) Caddick &Wilkin	.	1	.	1	1	.	1	2	1	.	.	.	6	III
G bulb	*Cyclamen hederifolium* Aiton	.	+	1	.	+	2	1	.	.	.	.	.	5	III
G rhiz	*Ruscus aculeatus* L.	.	+	1	.	+	1	+	.	.	.	.	.	5	III
P caesp	*Lonicera implexa* Aiton	.	.	+	.	2	1	.	1	.	.	.	1	5	III

Table 3. Continuation.

		a								b					
	Relevé number	1	2	3	4	5	6	7	8	9	10	11	12		
	Altitude (m a.s.l.)	295	340	340	380	390	400	375	380	360	380	390	390		
	Slope (°)	30	50	35	37	30	35	38	45	35	70	60	60		
	Aspect	N	NE	N	NW	W	W	N	N	W	NW	NW	NW		
Life	Area (m^2)	80	100	100	100	100	100	100	80	80	60	60	60		
form	Total cover	100	95	95	95	95	90	95	100	90	95	90	90		
	Shrub cover (%)	95	90	90	95	95	90	90	90	90	90	80	85		
	Herb cover (%)	50	80	65	60	80	80	30	45	40	40	50	40		
	Average vegetation height (m)	1.4	1.4	1.2	1.3	1.2	1.1	2.8	3.3	0.9	0.8	0.8	1.0		
	Nb. of species per relevé	34	41	35	36	40	37	31	33	21	17	18	17	Presence	Frequency
G bulb	*Allium subhirsutum* L. subsp. *subhirsutum*	+	.	.	+	.	.	+	1	.	.	.	.	4	II
P lian	*Hedera helix* L.	.	.	1	.	.	.	2	2	.	.	.	1	4	II
NP	*Rosa sempervirens* L.	.	.	.	1	1	.	2	1	.	.	.	.	4	II
H ros	*Asplenium onopteris* L.	.	.	+	.	+	.	.	1	.	.	.	.	3	II
P caesp	*Rhus coriaria* L.	2	.	.	1	.	.	.	.	.	.	.	.	2	II
P caesp	*Phillyrea latifolia* L.	1	.	.	.	.	+	.	.	.	.	.	.	2	II
H scap	*Pulicaria odora* (L.) Rchb.	+	.	.	.	.	.	.	+	.	.	.	.	2	II
H scap	*Carex caryophyllea* Latourr.	.	.	.	.	.	+	.	.	.	.	.	.	1	I
P scap	*Quercus suber* L.	.	.	.	.	.	.	.	2	.	.	.	.	1	I
NP	*Euphorbia characias* L.	.	.	.	.	.	.	.	1	.	.	.	.	1	I
	Other species														
H caesp	*Brachypodium retusum* (Pers.) P. Beauv.	3	3	1	4	4	3	.	1	2	.	1	.	9	IV
NP	*Rubus ulmifolius* Schott	1	1	.	3	1	2	4	4	.	.	.	.	7	III
H ros	*Polypodium cambricum* L.	+	1	.	2	+	.	1	.	+	+	.	.	7	III
NP	*Cistus creticus* L. subsp. *eriocephalus* (Viv.) Greuter & Burdet	.	.	.	1	1	3	.	.	1	+	+	2	7	III
H scap	*Parietaria judaica* L.	2	.	2	+	1	+	.	.	.	.	.	.	5	III
T scap	*Mercurialis annua* L.	2	.	+	+	1	+	.	.	.	.	.	.	5	III
P scap	*Pinus pinea* L.	3	.	2	3	2	2	.	.	.	.	.	.	5	III
H scap	*Foeniculum vulgare* Mill. subsp. *vulgare*	2	.	+	+	.	+	+	.	.	.	.	.	5	III
G rhiz	*Arum italicum* Mill.	+	.	+	2	+	.	.	.	.	.	.	.	4	II
H caesp	*Oloptum miliaceum* (L.) Röser & H.R. Hamasha	1	.	2	.	1	+	.	.	.	.	.	.	4	II
H scap	*Thapsia asclepium* L.	.	+	.	1	1	1	.	.	.	.	.	.	4	II
Ch suffr	*Brassica villosa* Biv. subsp. *bivonana* (Mazzola & Raimondo) Raimondo & Mazzola	.	1	+	.	.	.	.	.	.	1	+	.	4	II
P caesp	*Crataegus laevigata* (Poir.) DC.	.	+	.	.	.	.	+	1	.	.	.	.	3	II
H bienn	*Silene latifolia* Poir.	.	+	.	.	.	.	+	+	.	.	.	.	3	II
G bulb	*Oxalis pes-caprae* L.	.	.	+	.	2	1	.	.	.	.	.	.	3	II
NP	*Coronilla valentina* L.	.	.	.	+	1	2	.	.	.	.	.	.	3	II
H bienn	*Sonchus oleraceus* L.	.	+	+	.	.	.	.	.	.	.	.	.	2	II
H scap	*Carlina sicula* Ten. subsp. *sicula*	.	+	.	.	1	.	.	.	.	.	.	.	2	II
H scap	*Bituminaria bituminosa* (L.) C.H. Stirt.	.	+	.	.	+	.	.	.	.	.	.	.	2	II
H scap	*Ferula communis* L.	.	+	.	.	.	.	.	+	.	.	.	.	2	II
T scap	*Theligonum cynocrambe* L.	.	.	.	.	1	1	.	.	.	.	.	.	2	II
P caesp	*Spartium junceum* L.	.	.	.	.	+	1	.	.	.	.	.	.	2	II
G bulb	*Charybdis pancration* (Steinh.) Speta	.	.	.	.	.	+	+	.	.	.	.	.	2	II
T scap	*Lathyrus oleraceus* Lam. subsp. *biflorus* (Raf.) H. Schaef., Coulot & Rabaute	.	+	.	.	.	.	.	.	.	.	.	.	1	I
H ros	*Hyoseris radiata* L.	.	+	.	.	.	.	.	.	.	.	.	.	1	I
T scap	*Tordylium apulum* L.	.	+	.	.	.	.	.	.	.	.	.	.	1	I
T scap	*Geranium lucidum* L.	.	+	.	.	.	.	.	.	.	.	.	.	1	I

Table 3. Continuation.

		a								b					
	Relevé number	1	2	3	4	5	6	7	8	9	10	11	12		
	Altitude (m a.s.l.)	295	340	340	380	390	400	375	380	360	380	390	390		
	Slope (°)	30	50	35	37	30	35	38	45	35	70	60	60		
	Aspect	N	NE	N	NW	W	W	N	N	W	NW	NW	NW		
Life	Area (m²)	80	100	100	100	100	100	100	80	80	60	60	60		
form	Total cover	100	95	95	95	95	90	95	100	90	95	90	90		
	Shrub cover (%)	95	90	90	95	95	90	90	90	90	90	80	85		
	Herb cover (%)	50	80	65	60	80	80	30	45	40	40	50	40		
	Average vegetation height (m)	1.4	1.4	1.2	1.3	1.2	1.1	2.8	3.3	0.9	0.8	0.8	1.0		
	Nb. of species per relevé	34	41	35	36	40	37	31	33	21	17	18	17	Presence	Frequency
H scap	*Clinopodium vulgare* L. subsp. *arundanum* (Boiss.) Nyman	.	.	+	.	.	.	.	.	.	.	.	.	1	I
H ros	*Hypochoeris laevigata* (L.) Ces., Pass. & Gibelli	.	.	+	.	.	.	.	.	.	.	.	.	1	I
H scap	*Origanum vulgare* L. subsp. *viridulum* (Martrin-Donos) Nyman	.	.	+	.	.	.	.	.	.	.	.	.	1	I
G rhiz	*Asphodelus ramosus* L.	.	.	.	+	.	.	.	.	.	.	.	.	1	I
H scap	*Pimpinella anisoides* V. Brig.	.	.	.	.	.	+	.	.	.	.	.	.	1	I
H bienn	*Vicia dasycarpa* Ten.	.	.	.	.	.	.	+	.	.	.	.	.	1	I
H bienn	*Geranium robertianum* L.	.	.	.	.	.	.	+	.	.	.	.	.	1	I
H scand	*Convolvulus silvaticus* Kit.	.	.	.	.	.	.	+	.	.	.	.	.	1	I
P caesp	*Ulmus minor* Mill.	.	.	.	.	.	.	.	1	.	.	.	.	1	I
Ch suffr	*Centaurea panormitana* Lojac.	.	.	.	.	.	.	.	.	1	.	.	.	1	I
Ch frut	*Lomelosia cretica* (L.) Greuter & Burdet	.	.	.	.	.	.	.	.	.	.	+	.	1	I
Ch suffr	*Helichrysum pendulum* (C. Presl) C. Presl	.	.	.	.	.	.	.	.	.	.	.	+	1	I

and ledges of the carbonatic mountains between Palermo and Trapani (northwestern Sicily), albeit under more xeric climatic conditions. In these contexts, infact, *Rhamno alaterni-Euphorbietum dendroidis* plays a secondary role as well, tending towards the holm oak woodland referred to the *Rhamno alaterni-Querco ilicis* sigmetum series (Brullo & Marcenò 1985; Brullo et al. 2009; Gianguzzi et al. 2015, 2016).

Overwhelmed by the dominance of *P. greuteri*, the species of the class *Quercetea ilicis* found in the relevés of the *Malvo olbiae-Ptilostemonetum greuteri typicum* generally perform low cover but are nonetheless very frequent (usually 12-15 taxa and half of the total species number per relevé: see Tab. 3, rels 1–8).

Further interesting remarks arise from the analysis of Tab. 4 (and Appendix II), which provides a synoptic overview on the communities framed into the *Oleo sylvestris Ceratonion siliquae* alliance known so far for Sicily. In fact, this table underlines the strong connection of some of the "critical" species mentioned above, like *Rubia peregrina, Smilax aspera* and *Ampelodesmos mauritanicus*, with the communities belonging to the class *Quercetea ilicis*. The table also highlights that the relevés of *Malvo albiae-Ptilostemonetum greuteri* presented in this paper count as many as 22 characteristics of the class *Quercetea ilicis*. Altogether, these data provide further support to the syntaxonomic interpretation given by the authors and to the classification proposed in the following scheme.

Upgrade of the main threats and supplementary data supporting species risk assessment

The screes where *P. greuteri* vegetation occurs are very dynamic habitats and are subject to frequent natural disturbance due to the continuous inflow of clastic material collapsing from the cliffs above, but the species seems to be perfectly adapted to deal with this natural disturbance factor. According to the IUCN-CMP Unified Classification of Direct Threats (IUCN-CMP 2011), the main threats to the species and coenosis belong to the following categories: "1.1 - Habitat loss/degradation, agriculture": a decrease in available habitat was found, as the stands are located within reforested areas; "10.5 - Human disturbance, fire": both stands are exposed to the frequent burning; the rocky and detrital-clastic habitats that the vegetation prefers, however, appear less exposed to the passage of fire or able to limit permanent damages; "12.1 - Other threats": an intrinsic risk factor is given by the fragmentation of the habitat and the small size of both populations. Even if *P. greuteri* is a relative of several palatable Asteraceae (e.g., *Cynara, Scolymus*), grazing-browsing disturbance does not worth being listed among the risk factors affecting this species. In fact, although some dozens of goats are regularly present near one subpopulation and the porcupines are extremely active in the other, any biting or

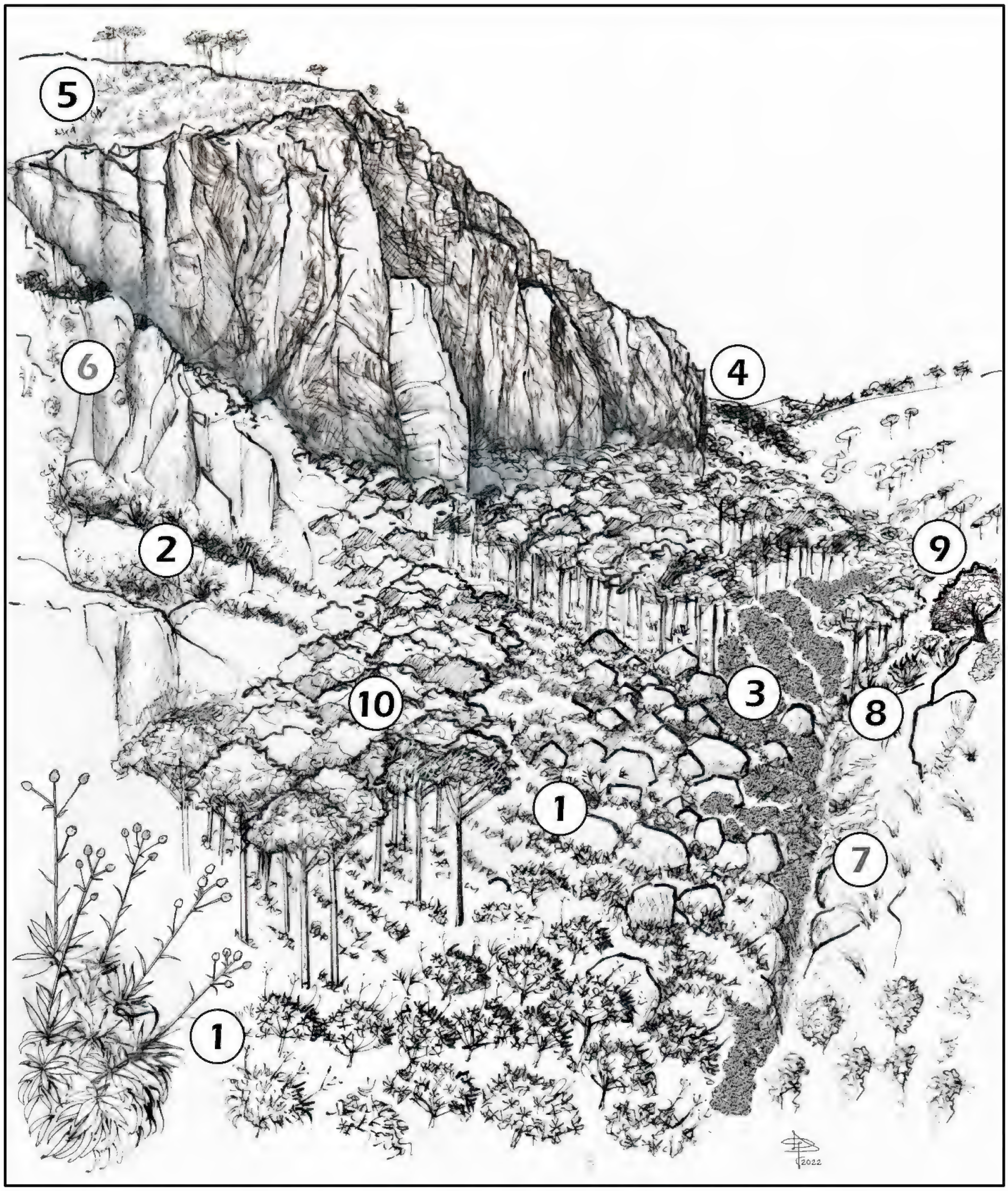

Figure 3. Schematic transect of the landscape units occurring on the N-facing slopes of Locality Pedrazzi, on the right streamside of Torrente Vaddunicchio: (1) pioneer maquis with *Ptilostemon greuteri* on debris slopes (*Malvo olbiae-Ptilostemonetum greuteri* subass. *typicum*); (2) lithophilous maquis co-dominated by *Ptilostemon greuteri*, *Chamaerops humilis* and *Euphorbia bivonae* on rocky ledges (*Malvo olbiae-Ptilostemonetum greuteri* subass. *euphorbietosum bivonae*); (3) thicket with *Fraxinus ornus* and *Pistacia terebinthus* (aggr. with *F. ornus* and *P. terebinthus*); (4) woodland with *Quercus ilex* and thermophilous deciduous trees (*Rhamno alaterni-Quercetum ilicis* subass. *pistacietosum terebinthi*); (5) grassland with *Ampelodesmos mauritanicus* (*Helictotricho convoluti-Ampelodesmetum mauritanici*) and garrigue with *Erica multiflora* and *Micromeria fruticulosa* (*Erico multiflorae-Micromerietum fruticulosae*); (6) chasmophytic community (all. *Dianthion rupicolae*); (7) grasslands with *Hyparrhenia hirta* on S-SE facing xeric slopes (all. *Hyparrhenion hirtae*); (8) scrub with *Chamaerops humilis* (*Pistacio lentisci-Chamaeropetum humilis*); (9) small nuclei of tall maquis with *Olea europaea* var. *sylvestris* (*Ruto chalepensis-Oleetum sylvestris*); (10) artificial forest stands with *Pinus pinea*.

Table 4. Simplified synoptic table of the Sicilian associations referred to the alliance *Oleo sylvestris-Ceratonion siliquae*. The values into squares refer to characteristic or differential species, while the symbol (*) points out the dominant species of a given association (see Appendix II).

Association number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Nb. of relevés	20	6	7	17	20	14	9	8	13	6	6	5	8	12	7	12	7	8	10	7	7	7	12
Char. of association and subassociation																							
Euphorbia dendroides L.	V*	V*	V*	V*	I	II	.	.	.	.	.	.	III	V	.	V*	I	IV	.	.	.	.	.
Phlomis fruticosa L.	.	V	.	.	.	.	.	.	.	.	.	.	.	V*	I	.	.	.	II	.	.	.	.
Euphorbia bivonae Steud.	.	.	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III
Ephedra major Host subsp. *major*	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhamnus lycioides L. subsp. *oleoides* (L.) Jahand. & Maire	.	.	.	V	I	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.
Celtis tournefortii Lam. subsp. *aetnensis* (Tornab.) Raimondo & Schicchi	.	.	.	.	.	V*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poterium spinosum L.	.	.	.	.	.	.	V*	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.
Myrtus communis L.	II	.	.	.	.	.	.	.	V	II	.	.	.	.	I	.	.	.	.	.	.	.	.
Ephedra fragilis Desf.	.	II	.	.	.	.	.	III	V	V	.	.	.	.	III	.	.	.	.	.	.	.	.
Lycium europaeum L.	.	.	.	.	.	.	.	.	.	V*	.	.	.	.	.	.	.	.	.	.	.	.	.
Ziziphus lotus (L.) Lam. subsp. *lotus*	.	.	.	.	.,	.	.	.	.	.	V*	.	.	.	.	.	.	.	.	.	.	.	.
Quercus coccifera L.	.	.	.	.	.	.	.	.	.	.	.	V*	.	.	.	.	.	.	.	.	.	.	.
Pyrus spinosa Forssk.	.	I	.	.	.	II	.	.	.	.	.	.	V	I	.	.	.	.	I	.	.	.	.
Salvia fruticosa Mill. subsp. *thomasii* (Lacaita) Brullo, Guglielmo, Pavone & Terrasi	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	.	.	.	.	.	.	.	.
Juniperus turbinata Guss.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V*	.	.	.	.	.	.	.	.
Acanthus mollis L.	.	.	.	.	.	III	.	.	.	.	.	.	.	.III	.	.	V	I	.	V	.	I	IV
Artemisia arborescens (Vaill.) L.	II	.	I	I	I	.	.	.	.	.	II	.	.	.	.	III	II	V*	.	.	.	I	.
Anagyris foetida L.	I	.	I	I	.	.	.	.	.	.	.	.	.	.	.	II	III	.	V*	.	.	.	.
Emerus major Mill. subsp. *emeroides* (Boiss. & Spruner) Soldano & F. Conti	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.	V	.	IV	III
Bupleurum fruticosum L.	.	.	.	.	..	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V*	V*	V*	.
Spartium junceum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	
Ptilostemon greuteri Raimondo & Domina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V*
Malva olbia (L.) Alef.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V
Centranthus ruber (L.) DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V
Char. alliance *Oleo-Ceratonion*																							
Olea europaea L. var. *sylvestris* (Mill.) Lehr.	IV	II	V	V	III	I	II	II	IV	III	II	I	I	IV	IV	V*	V*	.	I	.	.	II	.
Chamaerops humilis L.	III	II	V	I	V*	.	V*	II	V	IV	.	IV	I	II	III	I	V	I	I	.	.	.	IV
Teucrium flavum L.	II	I	.	.	.	I	.	.	.	.	.	.	.	III	.	II	I	.	.	IV	V	I	V
Asparagus horridus L.	.	.	.	.	.	III	I	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Char. order *Pistacio-Rhamnetalia*																							
Stachys major (L.) Bartolucci & Peruzzi	IV	V	V	V	III	II	IV	V	IV	IV	.	III	III	V	II	V	IV	III	III	I	.	I	III
Teucrium fruticans L.	IV	II	II	III	IV	.	IV	V	V	V	.	II	I	V	II	III	III	.	.	I	.	II	II
Pistacia lentiscus L.	III	.	II	V	V*	.	III	V	V*	IV	.	II	I	IV	V	IV	V	.	.	.	.	III	I
Rhamnus alaternus L.	II	IV	IV	.	II	.	.	V	.	.	I	.	.	IV	I	IV	III	.	IV	.	II	III	II
Asparagus albus L.	I	I	V	.	III	.	III	.	.	IV	I	.	IV	III	I	III	IV	V	IV	.	.	.	.
Osyris alba L.	I	III	I	.	.	II	.	.	.	III	I	.	.	IV	.	II	III	II	III	I	II	II	.
Pistacia terebinthus L.	.	II	I	.	.	V	.	.	.	.	I	.	.	IV	.	III	I	.	I	.	.	.	V
Ceratonia siliqua L.	III	.	.	.	II	.	.	I	I	.	.	.	.	III	I	II	I	.	.	.	.	.	.
Clematis cirrhosa L.	.	.	II	.	.	III	.	.	.	.	.	.	.	I	.	III	II	I	.	.	.	I	III
Char. class *Quercetea ilicis*																							
Asparagus acutifolius L.	IV	IV	V	V	IV	V	V	V	V	V	IV	V	IV	V	IV	V	V	II	V	V	V	IV	IV
Rubia peregrina L.	II	.	V	II	III	IV	.	III	IV	V	IV	III	IV	III	II	IV	IV	I	III	V	V	V	V
Smilax aspera L.	II	.	II	.	III	III	.	II	IV	V	II	IV	II	II	.	IV	IV	.	II	III	.	III	V

Table 4. Continuation.

Association number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Nb. of relevés	20	6	7	17	20	14	9	8	13	6	6	5	8	12	7	12	7	8	10	7	7	7	12
Arisarum vulgare Targ. Tozz.	II	IV	I	II	II	.	IV	IV	II	V	V	II	IV	.	.	V	V	.	IV	III	I	I	III
Cytisus infestus (C. Presl) Guss. subsp. *infestus*	IV	II	IV	.	V	.	IV	.	III	IV	.	III	V*	V	IV	II	II	.	.	III	.	IV	.
Ampelodesmos mauritanicus (Poir.) T. Durand & Schinz	IV	I	V	III	III	I	.	.	.	.	I	.	III	II	.	III	III	II	.	I	IV	V	V
Daphne gnidium L.	II	.	I	I	I	IV	.	.	II	II	.	I	II	IV	.	I	II	.	.	.	I	.	.
Ruta chalepensis L.	I	.	IV	IV	.	V	.	.	.	.	I	.	V	V	.	III	I	III	IV	.	.	.	.
Phillyrea latifolia L.	.	.	I	III	I	I	II	.	IV	.	.	V	.	I	III	II	I	.	.	.	.	.	II
Dioscorea communis (L.) Caddick & Wilkin	I	II	I	.	.	III	.	.	.	.	.	.	.	.	I	II	I	.	.	II	.	I	III
Allium subhirsutum L.	I	I	I	II	I	IV	.	.	.	.	.	.	.	II	.	V	V	.	IV	.	.	.	II
Rosa sempervirens L.	.	.	.	.	.	II	.	.	.	.	.	.	I	.	.	II	I	I	III	III	IV	III	II
Euphorbia characias L.	.	.	.	.	.	V	.	.	.	.	.	.	.	I	.	I	I	.	V	II	I	I	I
Lonicera implexa Aiton	I	II	.	I	.	.	.	.	III	.	.	II	.	.	I	.	.	.	II	.	.	.	III
Cyclamen hederifolium Aiton	.	.	IV	.	.	IV	.	.	.	.	.	.	.	I	.	I	.	.	II	II	.	.	III
Fraxinus ornus L.	I	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	II	III
Cyclamen repandum Sm.	I	.	.	I	.	IV	.	.	.	.	.	I	.	.	.	III	.	.	.	.	.	I	.
Quercus ilex L.	.	.	.	.	.	I	.	.	.	.	.	II	.	.	.	.	.	.	.	IV	.	I	III

trampling damage due to herbivore mammals has never been noticed on its leaves and stems.

Recent field observations allow to emphasise the strongly deleterious effects of many insane reforestation activities carried out in Sicily in the past, often referred to - yesterday as today - with the misleading term of "environmental restoration" interventions. In particular, the massive reforestation carried out in the post-World War II period along the slopes of Mt. Inici presumably caused serious and prolonged damage to the residual population of *P. greuteri*, an unknown species at that time. In fact, in a first phase, the preparatory work required for the planting of the young pines probably had a heavy effect on the slope's pedomorphology (cutting local maquis, digging holes, opening service roads, etc.). Later, the growth of the pines and the development of their canopy took away suitable space and light for the species living in the understorey, and the thickening of the reforestation must have caused a further shrinkage of local subpopulation of *P. greuteri* and of the entire community linked to the scree (subass. *typicum*); consequently, only the few individuals relegated to the cliffs or rocky ledges survived (subass. euphorbietosum bivonae). Paradoxically, the large fire that devastated the locus classicus of Locality Pedrazzi on 2 July 2017 seems to have favoured the recent global population increase, despite wiping out all the adult individuals, totally unable to resprout (Pasta et al. *submitted*). Indeed, there is a rapid recovery of scrub vegetation ascribed to *Malvo olbiae-Ptilostemonetum greuteri*. Under the permanently cool and shady microclimatic conditions of these screes, this coenosis plays therefore a key pioneer-constructive role and tends to evolve towards the head of local series, locally represented by holm oak forest *Rhammo alaterni-Quercetum ilicis* (Brullo et al. 2009; Gianguzzi & La Mantia 2009). The prompt and exceptional response of *P. greuteri* to fire, with the appraisal of thousands of seedlings few years after last arson (Pasta et al. *submitted*), suggests that it is able create a conspicuous soil seedbank within a few years. Furthermore, the high germination rate of achenes after fire and the high number of established seedlings show that *P. greuteri* may quickly respond to fire by adopting a very effective "seeder" strategy.

The establishment of the scrubland ascribed to the subass. typicum, rather luxuriant and often continuous and rich in taxa characteristic of the class *Quercetea ilicis*, was probably facilitated by the increased availability of light and space in the understorey and the clearings of the pine forest affected by fire. The less disturbed aspects of the association are found on rocky ledges, in contact with chasmophytic vegetation, best characterised in locality Il Finestrone, where they also find shelter from possible fire damage.

Based on the criteria B1ab(iii)+2ab(iii) criteria, the penultimate risk assessment for *P. greuteri* (Rivers 2017) assigned this species the risk category "CR" (= Critically Endangered). The recent discovery of a second stand, as well as the census and mapping of the individuals present in both subpopulations, confirm the opportunity of

maintaining the species inthe same risk category; however, IUCN guidelines (IUCN Standards and Petitions Committee, 2022) suggest the adoption of different assessment criteria, i.e.: B1ab(iii)c(iv) (see Pasta et al. *submitted*). According to the most updated calculations (Pasta et al. *submitted*), the Area of Occupancy (AOO) of *P. greuteri* is 12 km2, while the EOO is 91.3 ha (= 0.913 km^2). However, to comply with the above-mentioned IUCN guidelines, which recommend that EOO should not be less than AOO to ensure consistency with the definition of AOO as an area within EOO, its value can also be equalled to 12 km^2.

Conclusions

Sicily and its satellite islands represent one of the main hotspots of plant biodiversity individuated in the Mediterranean Basin (Médail & Quézel 1997), showing and exceptionally high rate of endemism, as highlighted by several authors either from the floristic (Brullo et al. 1995; De Castro et al. 2008, 2015a, 2015b; Gianguzzi & La Mantia 2004; Guarino & Pasta 2017, 2018; Brullo & Brullo 2021), and the phytocoenotic point of view (Brullo et al. 2009; Gianguzzi et al. 2011, 2012, 2013, 2014a, 2014b, 2015, 2017; Guarino & Pasta, 2017). The coastal stretch of the western sector of Sicily (including the Egadi Archipelago) is home to few and often single stands of many palaeoendemic, disjunct and/or relict species which are regionally or even nationally rare, like *Oncostema hughii* (Tineo) Speta, *Thymus richardii* Pers. subsp. *nitidus* (Guss.) Jalas, *Erodium maritimum* (L.) L'Hér., Daphne sericea Vahl and *Thymelaea tartonraira* (L.) All. (Marettimo Island), *Pseudoscabiosa limonifolia* (Vahl) Devesa (Marettimo, Monte Corvo and Mt. Gallo), *Brassica macrocarpa* Guss. (Marettimo and Favignana islands), *Erica sicula* Guss. subsp. *sicula* (Mt. Cofano), *Simethis mattiazzi* (Vand.) Sacc. (Marettimo and Mt. Cofano), *Hieracium cophanense* Lojac. (Mt. Cofano and Monte Passo del Lupo), *H. lucidum* Guss. and *Genista gasparrinii* (Guss.) C. Presl (Mt. Gallo). Most of these taxa are considered climatic relicts, a small group of plants that were able to survive the Quaternary glacial events (Garfì et al. 2021). *P. greuteri* belongs to this group; it provides a very peculiar and somehow 'archaic' physiognomy to the woody communities described in this paper, where it occurs as a dominant/co-dominant species, incredibly set aside in few stands of high ecological and conservation value, which have only recently been discovered.

The field surveys carried out have shown that *P. greuteri* is strictly localised on rock ledges and incoherent north-facing screes located within two narrow stream incisions, on carbonatic substrates, at altitudes between 300-500 m a.s.l., in the thermo-Mediterranean bioclimatic zone, with a sub-humid ombrotype. Due to their physiognomy and the dominance of this enigmatic broadleaved lauriphyll, these communities are markedly different from other Mediterranean forest communities, particularly due to the dense lauriphyll foliage and the silvery colour of the young leaves and branch tips. In fact, this species suffers considerably from summer drought (July and August), given the characteristics of the leaf blade that tolerates little direct sunlight. Although scarce, from a purely physiognomic point of view, such scrubland aspects are very rare in the panorama of phytocoenoses related to the order *Pistacio-Rhamnetalia alaterni* and to the whole class *Quercetea ilicis*, and it is therefore proposed here to refer them to a new lithophilous, thermophilous and shade-tolerant coenosis *Malvo olbiae-Ptilostemonetum greuteri* ass. nova, framed in the *Oleo-Ceratonion* alliance. The only woody communities that show a certain physiognomic-structural analogy with those dominated by *P. greuteri* are those characterised by the dominance or co-dominance of *Bupleurum fruticosum*, i. e. *Hippocrepido emeri-Bupleuretum fruticosi*, described by Brullo et al. (1993) for the hot and humid slopes of some canyons of the Iblei Mountains (south-eastern Sicily) and *Spartio juncei-Bupleuretum fruticosi* occurring on the N-facing hills of the Madonie and Nebrodi Mts. (Raimondo & Ilardi 2009).

Considering the multiple disturbances affecting the species - also due to increasing anthropogenic pressure and widespread urbanisation of the nearby territory - *P. greuteri* results to be seriously threatened with extinction in the wild. Inspite of the recent demographic increase of the maquis community where it belongs, *P. greuteri* remains an intrisically vulnerable species due to its peculiar ecological requirements, which allow this species to survive only on the cool and shady slopes of the two aforementioned gullies located on the eastern slope of Mt. Inici, either on coarse and mobile screes (subass. *typicum*) or on the outcropping rocks of some ledges (subass. *euphorbietosum bivonae*).

Syntaxonomic scheme

QUERCETEA ILICIS Br.-Bl. in Br.-Bl., Roussine & Nègre 1952
PISTACIO LENTISCI-RHAMNETALIA ALATERNI Rivas-Mart. 1975
Oleo sylvestris-Ceratonion siliquae Br.-Bl. ex Guinochet & Drouineau 1944
Malvo olbiae-Ptilostemonetum greuteri ass. nova
typicum subass. nova
euphorbietosum bivonae subass. nova

Other syntaxa quoted in the text

Asparago acutifolii-Ziziphetum loti Gianguzzi, Ilardi & Raimondo 1996; *Asparago albi-Artemisietum arborescentis* Gianguzzi, Cuttonaro, Cusimano & Romano 2016; *Calicotomo infestae-Juniperetum turbinatae* Brullo, Gianguzzi, La Mantia & Siracusa 2009; *Chamaeropo humilis-Oleetum sylvestris* Gianguzzi & Bazan 2019; *Chamaeropo humilis-Quercetum calliprini* Brullo & Marcenò 1985; *Chamaeropo humilis-Quercetum calliprini* Brullo

& Marcenò 1985; *Chamaeropo humilis-Sarcopoterietum spinosi* Barbagallo, Brullo & Fagotto 1979; *Ephedro fragilis-Lycietum europaei* Brullo & Marcenò 1985; *Euphorbio characiae-Anagyridetum foetidae* Gianguzzi, Cuttonaro, Cusimano & Romano 2016; *Hippocrepido emerici-Bupleuretum fruticosi* Brullo, Minissale, Scelsi & Spampinato 1993; *Myrto communis-Pistacietum lentisci* (Molinier 1954 em. O.Bolòs 1962) Rivas-Mart. 1975; *Oleo sylvestris-Euphorbietum dendroidis* Trinajstić 1974; *Pistacio lentisci-Chamaeropetum humilis* Brullo & Marcenò 1985; *Pistacio terebinthi-Celtidetum aetnensis* Gianguzzi, Cusimano & Romano 2014; *Pyro amygdaliformis-Calicotometum infestae* Brullo, Gianguzzi, La Mantia & Siracusa 2009; *Rhamno alaterni-Euphorbietum dendroidis* (Trinajstić 1984) Géhu & Biondi 1997 subass. *typicum*; *Rhamno alaterni-Euphorbietum dendroidis* (Trinajstić 1984) Géhu & Biondi 1997 subass. *euphorbietosum bivonae* (Gianguzzi, Ilardi & Raimondo 1996) Gianguzzi, Cuttonaro, Cusimano & Romano 2016; *Rhamno alaterni-Euphorbietum dendroidis* (Trinajstić 1984) Géhu & Biondi 1997 subass. *phlomidetosum fruticosae* (Brullo & Marcenò 1985) Gianguzzi, Cuttonaro, Cusimano & Romano 2016; *Rhamno alaterni-Euphorbietum dendroidis* (Trinajstić 1984) Géhu & Biondi 1997 subass. *rhamnetosum oleoidis* (Brullo & Marcenò 1985) Gianguzzi, Cuttonaro, Cusimano & Romano 2016; *Ruto chalepensis-Oleetum sylvestris* Gianguzzi & Bazan 2019; *Salvio fruticosae-Phlomidetum fruticosae* Barbagallo, Brullo & Fagotto 1979; *Sarcopoterio spinosi-Chamaeropetum humilis* Barbagallo, Brullo & Fagotto 1979; *Teucrio fruticantis-Rhamnetum alaterni* Brullo, Minissale, Scelsi & Spampinato 1993.

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Appendixes

Appendix I: Localities and date of relevés reported in Tab. 3

Table 3: Relevés 1–6: slopes of the locus classicus of locality Pedrazzi (Castellammare del Golfo, Trapani Province, 15.6.2020); Relevés 7–8: slopes of Pizzo Monaco (Castellammare del Golfo, Trapani Province, 12.5.2022); Relevé 9: NW-facing rocky ledges of the locus classicus of locality Pedrazzi (Castellammare del Golfo, Trapani Province, 12.5.2022); Relevés 10–12: NW-facing rocky ledges of Pizzo Monaco (Castellammare del Golfo, Trapani Province, 15.6.2020).

Appendix II: Associations corresponding to the numeric codes in Table 4

1: *Rhamno alaterni-Euphorbietum dendroidis* subass. *typicum*, from BRULLO & MARCENÒ (1985), Tab. 19 (sub *Oleo-Euphorbietum dendroidis*).

2: *Rhamno alaterni-Euphorbietum dendroidis* subass. *phlomidetosum fruticosae*, BRULLO & MARCENÒ (1985), Tab. 20, rels 1–6.

3: *Rhamno alaterni-Euphorbietum dendroidis* subass. *euphorbietosum bivonae*, from GIANGUZZI & LA MANTIA (2009), Tab. 11.

4: *Rhamno alaterni-Euphorbietum dendroidis* subass. *rhamnetosum oleoidis*, from BRULLO et al. (2009) Tab. 3 (col. 16).

5: *Pistacio lentisci-Chamaeropetum humilis*, from BRULLO & MARCENÒ (1985), Tab. 22.

6: *Pistacio terebinthi-Celtidetum aetnensis*, from GIANGUZZI et al. (2014), Tab. 2.

7: *Sarcopoterio spinosi-Chamaeropetum humilis*, da BARTOLO et al. (1982) Tab. 29 (sub *Chamaeropo humilis-Sarcopoterietum spinosi*).

8: *Teucrio fruticantis-Rhamnetum alaterni*, from TURRISI et al. (2002), Tab. 8.

9: *Myrto communis-Pistacietum lentisci*, from BARTOLO et al. (1982), Tab. 28.

10: *Ephedro fragilis-Lycietum europaei*, from BRULLO & MARCENÒ (1985), Tab. 24.

11: *Asparago acutifolii-Ziziphetum loti*, from GIANGUZZI et al. (1996), Tab. 4.

12: *Chamaeropo humilis-Quercetum calliprini*, from BRULLO et al. (2009), Tab. 3 (col. 32).

13: *Pyro amygdaliformis-Calicotometum infestae*, from GIANGUZZI & LA MANTIA (2009), Tab. 12.

14: *Salvio fruticosae-Phlomidetum fruticosae*, da BARBAGALLO et al. (1979), Tab. 2, rels 1–12.

15: *Calicotomo infestae-Juniperetum turbinatae*, BRULLO et al. (2009) Tab. 3e.

16: *Ruto chalepensis-Oleetum sylvestris*, from GIANGUZZI & BAZAN (2019) Tab. S1.

17: *Chamaeropo humilis-Oleetum sylvestris*, da GIANGUZZI & BAZAN (2019), Tab. S4.

18: *Asparago albi-Artemisietum arborescentis*, from GIANGUZZI et al. (2016), Tab. 6.

19: *Euphorbio characiae-Anagyridetum foetidae*, from GIANGUZZI et al. (2016), Tab. 7.

20: *Hippocrepido emeri-Bupleuretum fruticosi*, from BRULLO et al. (1993), Tab. 3.

21: Aggr. with *Bupleurum fruticosum*, from MARCENÒ et al. (2011), Tab. 2.

22: *Spartio juncei-Bupleuretum fruticosi*, from RAIMONDO & ILARDI (2009), Tab. 1.

23: *Malvo olbiae-Ptilostemonetum greuteri* ass. nova.